

Ship Survivability Enhancement



The vulnerability of a ship can be reduced considerably by applying survivability enhancement measures.

Threats and hazards

A ship can be threatened by hostile weapons, terrorist's attacks or accidents.

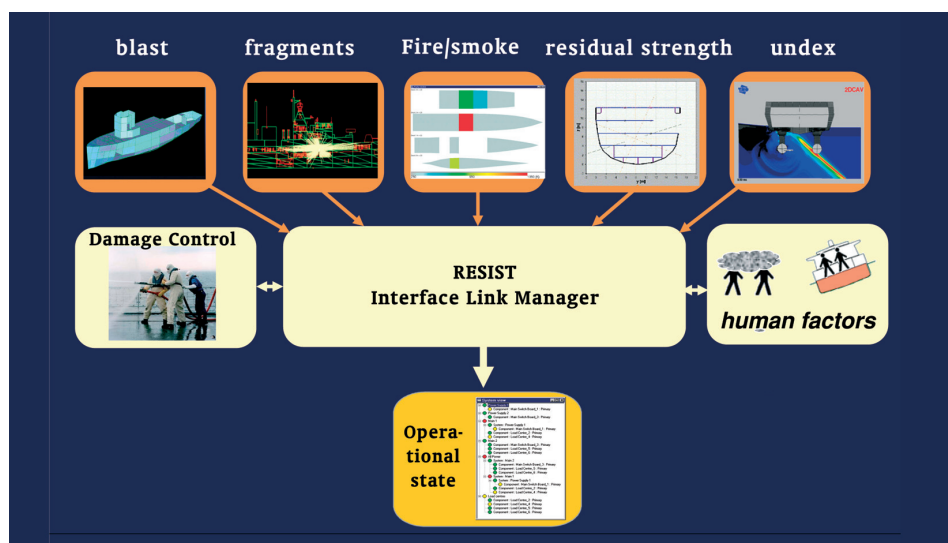
Hazards to the ship can come from:

- Small caliber ammunition firing (AK-47)
- RPG-7 shaped charge
- Artillery fire from the coast
- A close-in explosion
- An underwater explosion
- An external or internal explosion of a missile warhead
- An external or internal explosion of a naval shell
- An accident, causing fire or an explosion

Balanced approach

Several measures can be taken in order to reduce the damage to the ship, inflicted by weapons or accidents. An optimum set of chosen measures is required, given the threat specifications from the customer. A balance between benefits and penalties, like costs and weight, must be found.

TNO has developed simulation tools that have proven to be valuable in the ship design or for existing ships for comparing the effects of all kinds of measures and for deciding on a minimum set of necessary measures, given a certain threat.



Balanced design.

Measures that can be taken are:

- System layout optimization (e.g. cable and piping rerouting)
- Explosion resistant bulkheads and doors at appropriate locations
- Damage Control improvement
- Explosion suppression (water mist)
- Ballistic protection of vital compartments, equipment, pipes and cables
- Topside and sensor protection
- Box girders
- Explosion resistant hull construction
- Dynamic reconfiguration of power and cooling water distribution systems

When taken into account in the early design phase of a ship, implementation of these measures can be realised by only minor structural adaptations and therefore at relatively low cost and hardly any mass penalty.

Competences

TNO has the tools and experience to advise on the choice and implementation of an optimum set of vulnerability reduction measures, given a certain threat.

TNO has designed suitable lightweight blast and fragment resistant bulkheads and doors, and ballistic concepts based on validated and tested concepts. TNO's survivability enhancement concepts have been applied in the RNLN LCF frigates, the RNoN type 310 frigates and the RN type 45 destroyers.

Results

The measures can result in a significant reduction of the operational degradation due to a hit. Calculations (example) on some specific implementations have shown:

- 60% reduction in the expected degradation of AAW capacity
- 50% reduction in the expected degradation of ASuW capacity
- 70% reduction in the expected degradation of mobility
- 40% reduction in the expected number of casualties

TNO Defence, Security and Safety

'TNO Defence, Security and Safety' is the title under which TNO operates as a strategic partner for the Dutch Ministry of Defence and makes innovative contributions to enhance the safety and security of the Netherlands both at home and abroad. We also use our accumulated knowledge for businesses, industries and foreign governments.

André van Erkel

T +31 15 284 35 65
M +31 6 51 765 821
F +31 15 284 39 39

Lange Kleiweg 137
P.O. Box 45
2280 AA Rijswijk
The Netherlands

info-DenV@tno.nl
www.tno.nl

RNLN's LCF, designed for low vulnerability.

